19 Wilson Lake

19.1 General Background

Wilson Lake was impounded in 1964 and reached full multipurpose pool on 12 March 1973. The primary water quality threats to Wilson Lake are nutrients and runoff / groundwater contamination from the Russell landfill. Wilson Lake as the nickname as the 'Clearest Lake in Kansas'. The lake is listed on the state's 303(d) list for water quality impairment due to sulfates and chlorides. The discharge of groundwater from the Dakota aquifer is the primary source of chloride in surface waters flowing into Wilson Lake. Because achievement of the chloride water quality standard (250 mg/L) is not possible due to natural inputs, an alternative endpoint has been proposed. The TMDL, developed by KDHE, will seek to maintain chloride concentrations < 860 mg/L (acute chronic life criteria) during normal flow conditions and higher concentrations will be allowed during drought conditions.

19.1.1 Location

Wilson Lake is located approximately 32 km (20 miles) east of Russell, Kansas. The dam is located at river kilometer 208.6 (river mile 130.4) of the Saline River. The watershed encompasses Russell, Ellis, Rooks, Osborne, and Trego Counties. Historic water quality sample sites at Wilson Lake include 1 inflow, 3 lake, and 1 outflow (Figure 19.1).

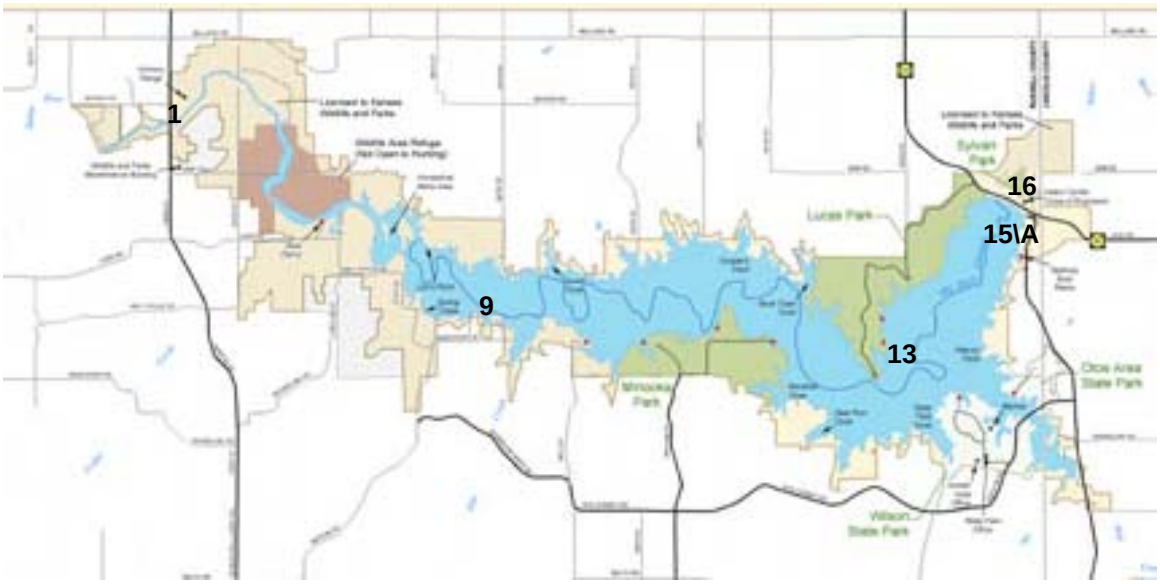


Figure 19.1. Wilson Lake area map with sample site locations.

19.1.2 Authorized Purposes: Flood control, recreation, fish and wildlife management, water supply, water quality improvement.

19.1.3 Lake and Watershed Data

Pools	Surface Elevation (ft. above m.s.l.)	Current Capacity (1000 AF)	Surface Area (A)	Shoreline (miles)
Flood Control	1,554.0	529.8	20,000	
Multipurpose	1,516.0	233.6	9,000	100
Total		763.4		

Total watershed area: 1,917 sq miles (1,226,880 A)

Watershed ratio: 61.34 FC / 136.32 MP

Average Annual Inflow: 97,845 acre-feet
Average Annual outflow: 000 acre-feet
Average flushing rate:
Sediment inflow (measured): 15,066 acre-feet (1964 – 1993)

19.2 2005 Activities

Wilson Lake was categorized at an 'intensive' lake during 2005, thus samples were collected from the single inflow, 3 lake, and single outflow sites (see Figure 19.1 for specific locations). Sample collections occurred from May through September 2005, with monthly vertical profiles (temperature, DO, pH, conductivity, and turbidity) recorded at the three lake sites. Wilson Lake staff (OF-WI) providing field sampling assistance during 2005 included Curtis Keller. Ken Nelson, OF-WI Operations Manager, provided insight and background regarding Wilson Lake.

19.3 2005 Data

Comparative historic data consists of monthly (April – September) data collected from 1996 through 2005.

19.3.1 Inflow

Inflow samples were collected from the watershed site located at the Highway 281 bridge crossing (Site 1). Historically, water quality parameters are most variable at this site due to influences of runoff events and climatic variations within the watershed.

19.3.2 Lake

Total nitrogen (TN) median concentrations from surfaced water samples collected from 1996 through 2005 range from 0.85 – 1.0 from lake sites and 1.21 mg/L from the inflow (Site 1)(Figure 19.2). Although low in respect to other district lakes, these values exceed EPA's proposed ecoregional nutrient criteria value of 0.56 mg/L. Total phosphorus (TP) median concentrations from surface water samples collected from 1996 through 2005 range from 0.03 – 0.05 mg/L from lake sites and 0.11 mg/L from the inflow (Site 1)(Figure 19.3).

The ratio of TN:TP can be used as a surrogate to determine the dominant algal community within a waterbody. Ratios $\geq$ 20:1 are indicative of desirable algal

communities, whereas ratios ≤ 12:1 are indicative of bloom-forming cyanobacteria (blue green algae). Median TN:TP ratios at all three lake sites are > 20, indicating the lake is not at risk for cyanobacteria blooms (Figure 19.4). These are among the highest TN : TP ratios measured within the district.

Total iron exceeded EPA's Drinking Water Standard of Secondary Maximum Contaminant Levels (SMCL) of 300 ug/L from surface samples collected during August at both the inflow (Site 1) and outfall (Site 16) but was only between 60 – 175 g/L from lake sites. Concentrations were 516 ug/L at Site 16 and 1250 ug/L at Site 1. Implications are directed at drinking water facilities related to taste and staining issues, but neither exceedence site served as a drinking water source. In addition, surface samples collected from both inflow and outflow during August exceeded EPA's SMCL for manganese (50 ug/L). Those concentrations were 390 ug/L (Site 1) and 63 ug/L (Site 16), while lake sites only ranged from 15 – 24 ug/L. Implications again are directed at drinking water facilities due to taste and stain issues.

Mean monthly chlorophyll *a* concentrations ranged from 8 – 15 ug/L, which indicates the lake is boarderline mesotrophic – eutrophic. Secchi depth was measured monthly from June through August at the three lake sites. Site 9 (upper lake) consistently had the lowest water clarity measurements (0.4 – 0.81 m), while the highest water clarity was

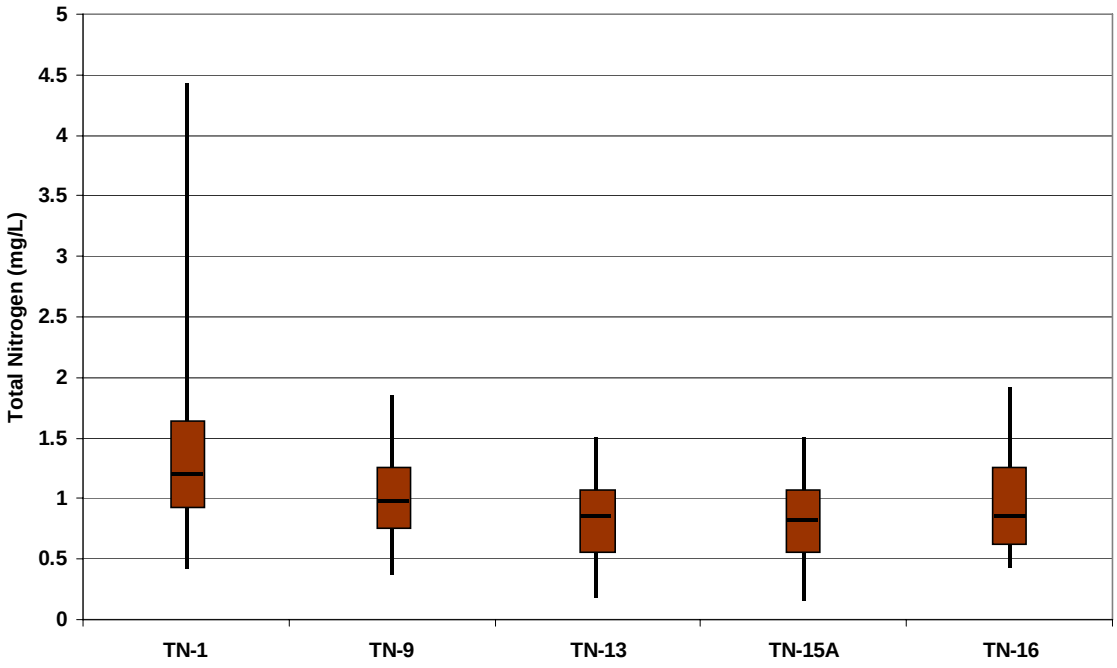


Figure 19.2. Box plots of surface water sample total nitrogen concentrations measured by site from 1996 through 2005 at Wilson Lake.

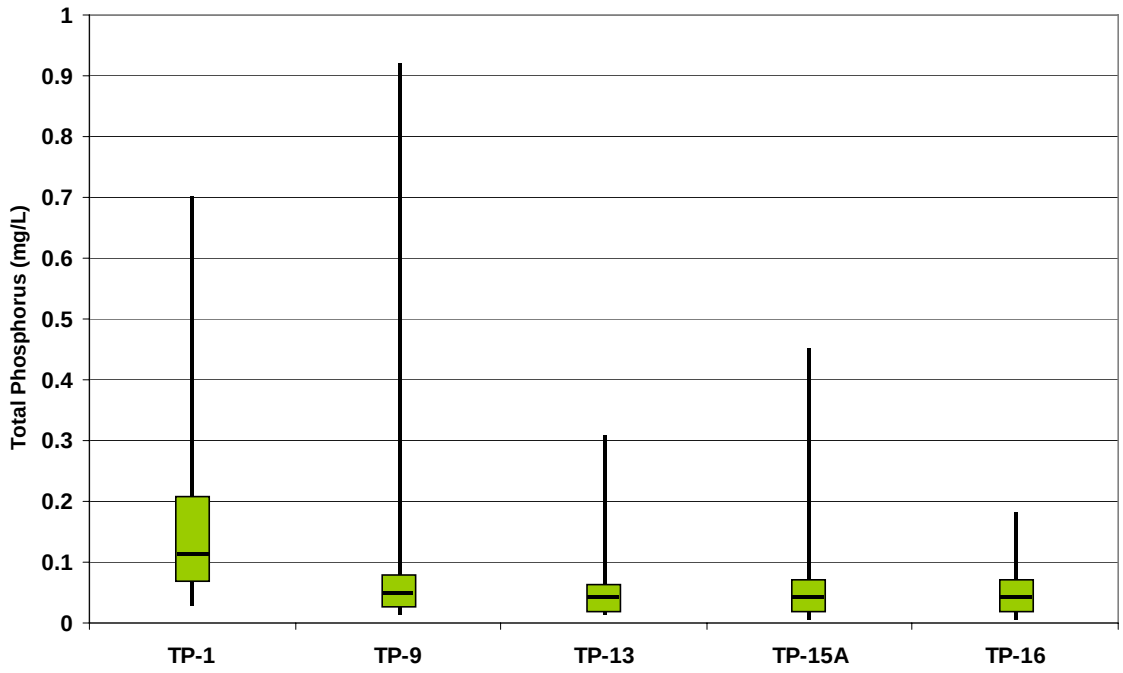


Figure 19.3. Box plots of surface water sample total phosphorus concentrations measured by site from 1996 through 2005 at Wilson Lake.

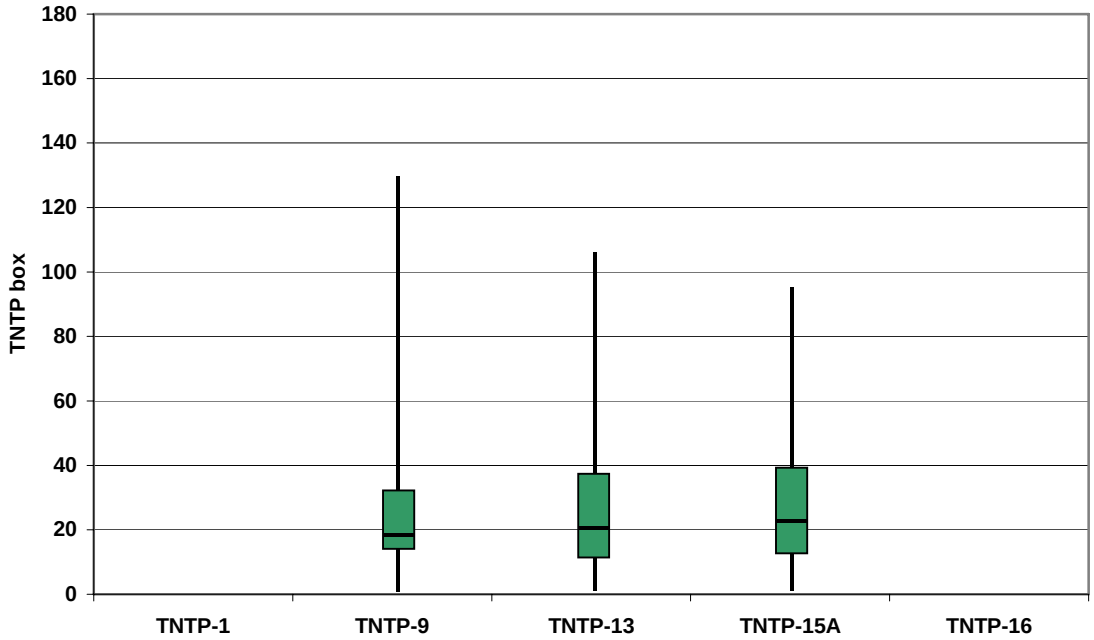


Figure 19.4. Box plots of total nitrogen : total phosphorus (TN : TP) ratio from surface samples collected by site from 1996 through 2005 at Wilson Lake.

measured near the tower at Site 15a (1.1 – 2.3 m) (Figure 19.5). The secchi depths measured at Site 15a were some of the deepest within the district.

Median atrazine concentrations collected from surface water samples between 1996 and 2005 ranged from 0.33 – 0.43 ug/L, which are the lowest within the district (Figure 19.6). This would be expected due to landuse practices within the watershed. In fact, individual samples have never exceeded EPA's drinking water maximum contaminant level of 3 ug/L.

Vertical profiles were recorded during sample trips in June, July, August and September 2005. Parameters included temperature, dissolved oxygen, pH, conductivity, and turbidity. Based on these profiles, the lake was strongly stratified thermally during June at 10m, at a depth of 15m in July, and not stratified thermally during August or September (Figure 19.7). Chemical stratification was weak during June, July and August, while the lake was homogeneous during September.

19.3.3 Outflow

Outflow samples were collected during 2005 from the stilling basin (Site 16). This data is discussed in concert with lake specific sites above.

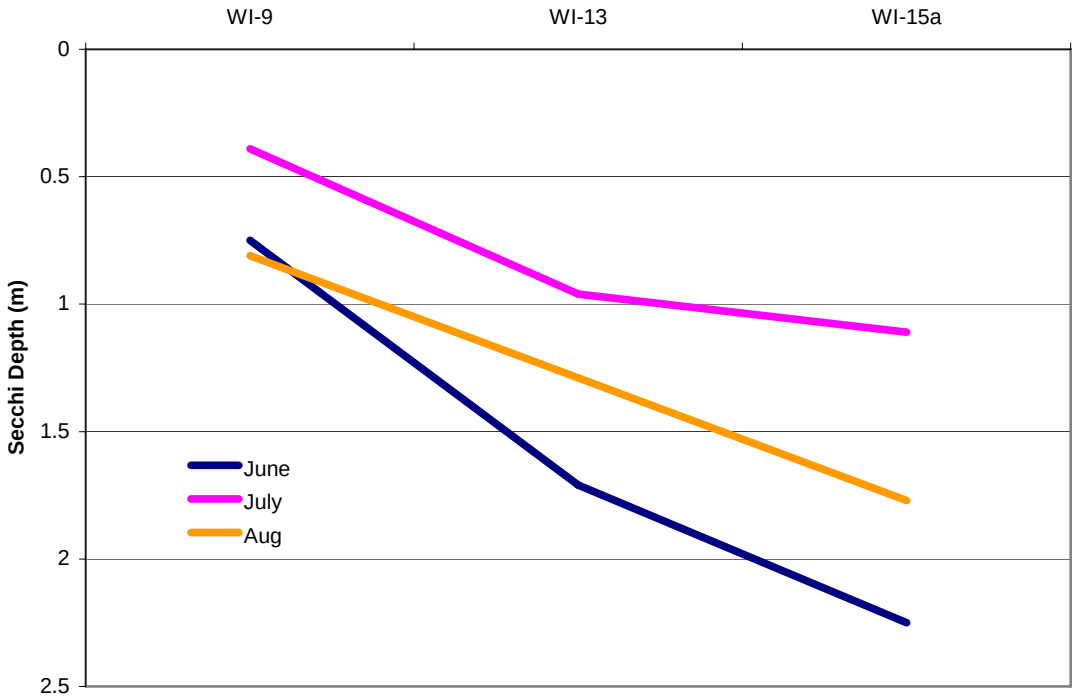


Figure 19.5. Secchi depth measurements by site from June through August 2005 at Wilson Lake.

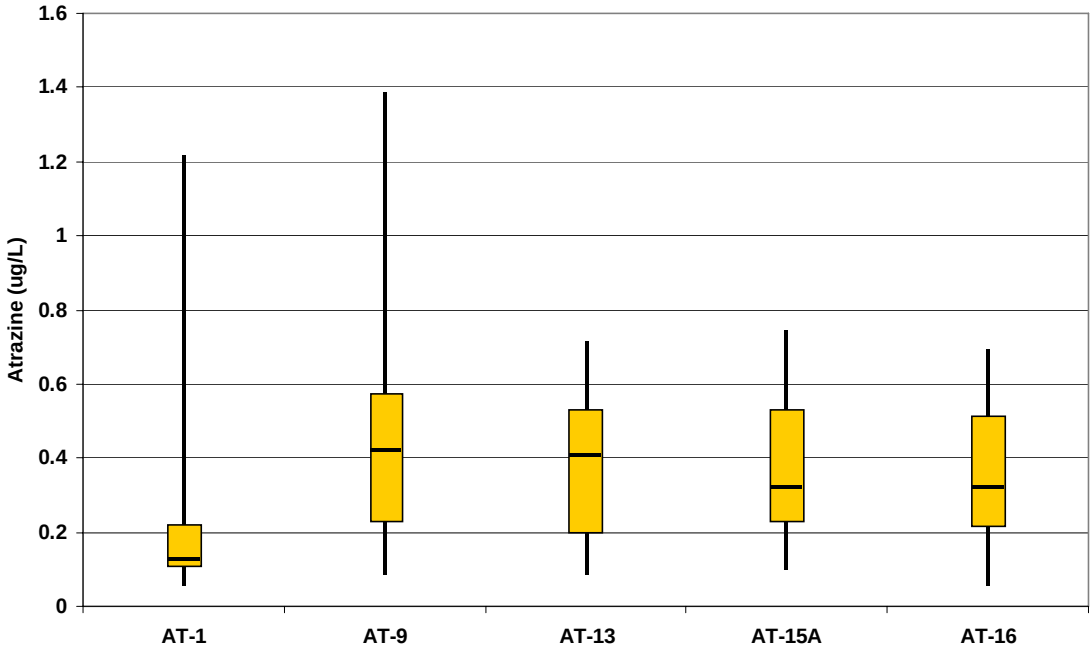
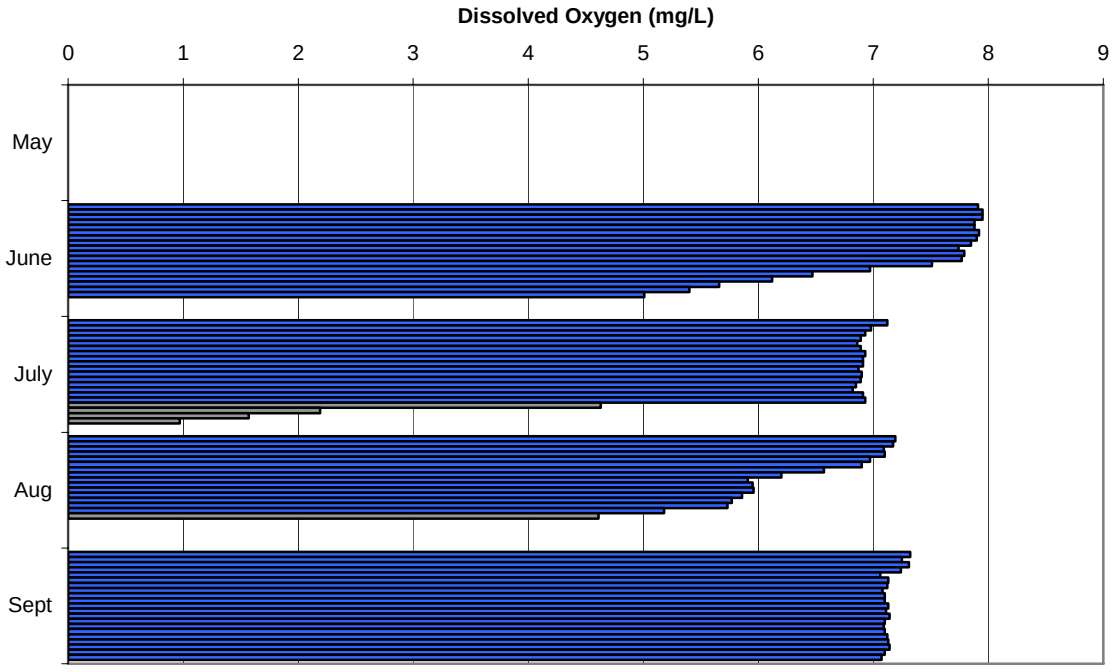


Figure 19.6. Box plots of surface water sample atrazine concentrations measured by site from 1996 through 2005 at Wilson Lake.



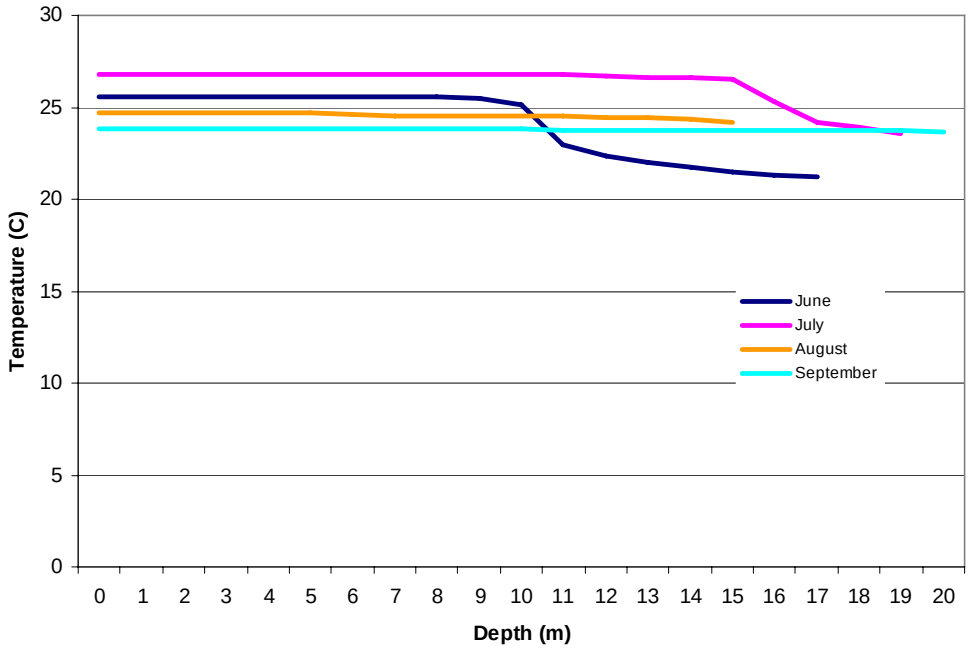


Figure 19.7. Dissolved oxygen concentration (mg/L) histogram and temperature (°C) plot from vertical profiles recorded at Site 15A (tower) from June through September 2005 at Wilson Lake.

19.4 Future Activities and Recommendations

Sampling activities for 2006 will include transition from 'intensive' to 'ambient' monitoring from April through August, as well as conducting at least one summer vertical profile at each of the three lake sites. No additional watershed sites were identified during the 2005 season.